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Does "Broken Windows" Law Enforcement Reduce Serious Crime?

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Letter from the Institute Director

This CICG Research Brief examines one of the most promising – and most controversial – law enforcement theories of recent years: the "Broken Windows" theory. According to this theory, aggressive targeting of minor crimes can lead to a reduction in more serious crimes down the road.

Intuitively, this theory makes sense. As minor offenses go unpunished, an air of lawlessness can pervade a community, in turn leading to an increase in serious crime. By aggressively targeting these minor offenses, serious crimes can be avoided.

In spite of its common sense appeal, broken windows has been the subject of heated debate. To its critics, broken windows law enforcement is nothing more than the "harassment" model of law enforcement.

The controversy surrounding broken windows has thus far failed to produce a satisfactory answer to one of the most fundamental questions about the strategy: does it work? That is, researchers have thus far been unable to demonstrate whether broken windows successfully accomplishes its stated goal of reducing serious crime.

In this CICG Research Brief, California State University, San Bernardino's John Worrall addresses this fundamental question. Professor Worrall's research indicates that broken windows can in fact be an effective tool in reducing serious crime in California counties.

It is our hope that this research can serve to improve law enforcement programs in California. Furthermore, we hope to spur additional research into the effectiveness of broken windows law enforcement.

On behalf of CICG, I want to thank all of the many people who contributed to this report. Of course, the report would not have been possible without the hard work, insights, talent and determination of John Worrall. In addition, CICG's Research Director, Eric Hays, worked with Professor Worrall to design the analysis, collect the necessary data, and prepare the final report. I also want to thank all of those who commented on early drafts of the report. CSAC's Rubin Lopez and Elizabeth Howard applied their extensive experience with county criminal justice issues to improving the final draft. Nick Warner looked at the research from the perspective of California's sheriffs. Travis Pratt of Rutgers University, Andrew Giacomassi of Boise State University, and Stephen Tibbetts of California State University, San Bernardino all reviewed the draft from a more academic perspective, and their comments have improved the analysis and the presentation of results.

Matthew Newman
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Executive Summary

Can vigorous enforcement of laws against low-level crimes prevent more serious crimes from occurring? This is the idea advanced by the "broken windows" theory of law enforcement first proposed by James Q. Wilson and George Kelling in 1979.[1] In the decades since the theory was advanced, researchers, law enforcement professionals, journalists, and elected officials have all expressed an interest in a broken windows law enforcement strategy that targets problems of physical (e.g., graffiti) and social (e.g., prostitution) disorder as a method of reducing serious crime.

Some have expressed concerns that the tactics endorsed by broken windows law enforcement can lead to harassment of the innocent. Others have embraced broken windows law enforcement and attribute success in reducing crime and sparing would-be criminals from incarceration to the strength of the theory.

Despite these competing views, a key question remains unanswered: Does broken windows law enforcement work? Over the years, several studies have sought to address this critical question. To date, however, researchers have not been able to conclusively support or refute the broken windows theory of law enforcement.

This research brief seeks to overcome the shortcomings of previous research in an effort to answer the question, does "broken windows" policing reduce serious crime? CICG conducted a macro-level analysis of the effects of broken windows law enforcement on serious crime in California, controlling for other factors linked to crime. The results of this analysis confirm that vigorous enforcement of laws against minor crimes can help to reduce the future incidence of more serious crimes. Specifically, the results indicate that more arrests for certain types of low-level misdemeanors can reduce the incidence of certain types of serious property crimes. Furthermore, the results indicate that charging practices of local district attorneys can have an impact on the crime rate. That is, if DAs prosecute minor offenses more vigorously, a reduction in serious crimes is likely to follow.

[1] See Wilson, J.Q. and G. Kelling. (1982). "Broken Windows: The Police and Neighborhood Safety." *Atlantic Monthly*, March, pp. 29-38.

Introduction

Twenty years ago, a pair of social scientists, James Q. Wilson and George Kelling, wrote an article for the Atlantic Monthly explaining their new "Broken Windows" theory of crime. They claimed that if low levels of disorder and deviance are not prioritized by law enforcement, more serious crime will likely follow.[2] They also claimed that when signs of disorder are ignored, problems of violence and delinquency will manifest and begin to spiral out of control. Thus, one way for law enforcement agencies to be effective in reducing serious crime is to begin by targeting minor problems.

The "broken windows" theory of crime seems sensible because it suggests that crime in our neighborhoods follows a fairly predictable pattern: when minor offenses such as prostitution or low-level drug dealing are ignored, citizens will begin to feel uncomfortable, perceive their neighborhood as unsafe, and curtail their activities. As citizens begin to withdraw in this fashion, the community bonds that presumably existed beforehand begin to break down, providing fertile ground for criminal activity (Kelling and Bratton 1998; Skogan 1990). Despite its attractiveness, the law enforcement strategy supported by Wilson and Kelling's theory has met with mixed reviews among researchers, the media, and the law enforcement community.

Many prominent law enforcement officials and researchers have argued that broken windows policing leads to reductions in serious crimes.[3] The media, by contrast, has been more critical of the aggressive policing strategies supported by the broken windows theory (e.g., Kocieniewski and Cooper 1998; O'Hara 1998). Broken windows has even been called the "harassment model of policing" (Panzarella 1998). In fact, some have argued that the theory is inherently flawed, relying on a misinterpretation of the history of criminal activity in neighborhoods (Walker 1984).

Despite criticism, Wilson and Kelling's ideas continue to be the subject of great attention among law enforcement experts. Many researchers, drawing on their ideas, have refined and extended the broken windows hypothesis (e.g., Kelling and Coles 1996; Skogan 1990; Skolnick and Bayley 1986, 1988). Nevertheless, important questions about the effectiveness of broken windows law enforcement remain unanswered.

Previous Research

Surprisingly little empirical research exists concerning the effectiveness of the "broken windows" law enforcement strategy in reducing serious crime. Direct tests of the theory are few and far between (the only exceptions appear to be Katz, Webb, and Schaefer 2001; Green 1996; Green-Mazerolle, Kadleck, and Roehl 1998; Kelling and Coles 1996; Novak et al. 1999). In addition, no one has successfully analyzed the relationship between the policing strategy supported by Wilson and Kelling's theory and the actual effect on crime, while controlling for other factors usually linked to changes in the crime rate. Finally, most studies of the broken windows theory have been limited to single-site evaluations (i.e., the micro- as opposed to macro-

[2] The literature identifies two types of "disorder": physical and social. Physical disorder refers to such problems as graffiti, run-down buildings, and property damage of all sorts. Social disorder refers to actions of individuals, and usually includes prostitution, vagrancy, suspicious persons, public drunkenness, and so on.

[3] See for example, Bratton (1996 and 1998) and Silverman's (1999) observations of the New York City Police Department.

level), calling into question the generalizability of the results.

While few *direct* tests of the broken windows theory have been performed, researchers have tested some of the ideas that flow from (and led up to) Wilson and Kelling's seminal argument.[4]

Fear, Disorder, and Crime

While subsequent research (Harcourt 1998, Eck and Maguire 2000, and Taylor 1999) has cast some doubt on his conclusions, Skogan (1990) was one of the first researchers to examine the relationship of fear and disorder to crime, phenomena considered inextricably linked by supporters of Wilson and Kelling's broken windows theory. He reported on a survey of 13,000 residents in 40 neighborhoods of six different cities and found that crime and fear were linked to disorder. He concluded that this relationship was even stronger than that between poor socioeconomic conditions and crime. He also concluded that disorder *preceded* crime in the neighborhoods surveyed.

Aggressive Policing

One method of policing that finds support in Wilson and Kelling's view is so-called "aggressive policing." The police, supporters claim, must aggressively target minor crime and disorder problems in order to send a signal that such problems will not be tolerated in the community. Indeed, this idea is nothing new, and it finds roots in policing practices that preceded the broken windows thesis.

Wilson and Boland (1978) were among the first researchers to examine the relationship between aggressive policing and crime. They found that as the number of traffic tickets issued increased, the serious crime rate declined. Later research by Sherman (1990) and Sherman, Gartin, and Buerger (1989) supports a similar conclusion. They found that aggressive enforcement of the laws in crime "hot spots" causes crime to decline.

Quality-of-Life Policing

Quality-of-life policing has found a wealth of support in the law enforcement community (e.g., Bratton 1996; Kelling and Bratton 1998) as well as in academia (e.g., Roberts 1999; Kelling and Coles 1996). In contrast to aggressive policing, which focuses on tough, "heavy-handed" law enforcement, quality-of-life policing is intended to make neighborhoods more pleasant and livable for those whose well-being is threatened by the presence of criminal activity.

Sherman (1990) found that focused enforcement of public drinking laws and parking regulations, when first publicized, caused citizens to feel safer. The strategy did not, however, appear to exert an influence on serious crime. In a more recent study, Novak et al. (1999) came to a similar conclusion, finding that enforcement of liquor laws did not affect the incidence of robberies or burglaries.

What appears to be the most recent study of quality-of-life policing paints a somewhat grim picture of the effectiveness of this strategy. Katz et al. (2001) found that quality-of-life policing reduces physical disorder and public morals offenses (e.g., prostitution), but little else. This is not a surprising conclusion considering that a major component of the enforcement strategy Katz and his colleagues studied involved policing physical disorder (mainly through code enforcement) and public morals offenses.

[4] For a more complete discussion of the previous research on Broken Windows, please see Appendix B.

Limitations of Previous Research

To date the evidence supporting the broken windows thesis is mixed. Few direct empirical tests of the theory have been conducted. And for those researchers who have examined the relationships between aggressive policing, quality-of-life policing, and crime, the jury is still out. The mixed reviews for the efficacy of broken windows law enforcement can be attributed, in part, to the research designs employed in the past.

First, very few researchers have attempted more than piecemeal tests of the broken windows thesis. Studies focusing primarily on traffic enforcement (e.g., Wilson and Boland 1978; Sampson and Cohen 1988) or liquor law enforcement (e.g., Novak et al. 1999; Sherman 1990) do not comport fully with the spirit of Wilson and Kelling's theory, which holds that targeting *several* minor problems reduces serious problems. In order to determine if the broken windows thesis is accurate, it is essential to study the whole gamut of minor offenses.

Another limitation of previous research in this area is that most of it has been city- or neighborhood-specific. Actually, this method of research is highly advantageous in terms of being able to understand the unique nature of policing in a given locale, or the particularities of a certain area, but it does not promote generalizability. In short, most, if not all, tests (direct and indirect) of the broken windows thesis have been micro-level in nature. By moving to the macro-level of analysis, policy makers in multiple locations can decide if the policing strategy supported by broken windows is best for them.

A third limitation of past research is that most of it does not take the time dimension into account. Cross-sectional research such as that conducted by Skogan (1990), Wilson and Boland (1978), Sampson and Cohen (1988), Cordner (1981), and others limits the ability of researchers to test the effects of enforcement of minor offenses on serious offenses over time. Wilson and Kelling's theory implies that minor problems *precede* serious ones, so research employing multiple observations over time is essential. A recent exception to this limitation can be found in the research reported by Katz et al. (2001), although their study fell victim to yet another problem in the research, discussed in the following section.

Most researchers studying the efficacy of broken windows policing, quality-of-life policing, aggressive policing, or similar law enforcement strategies have failed to control for alternative explanations for the outcomes under study. In one of the more sophisticated studies to date (Katz et al., 2001), the researchers were unable to control for other factors linked to the outcomes resulting from a quality-of-life policing initiative. Katz et al. (2001) acknowledged that this was a limitation inherent in the design, but in order to determine whether the policing strategy supported by the broken windows thesis is effective in reducing serious crime, researchers must control directly for factors linked to the crime rate.

Finally, a fatal flaw of many of the research designs discussed thus far is that they assume a one-way relationship, namely that minor problems precede serious ones. By extension, their conclusions that aggressive enforcement of minor problems reduces certain types of crimes may be inaccurate. It could be, for example, that serious crime influences the incidence of arrests for minor offenses.

Such an eventuality could be a natural consequence of a decrease in serious crime, leaving the police more resources with which to target minor offenses. This is known as an "endogeneity" problem; arrests may affect serious crime and vise versa. In order to determine whether Wilson and Kelling's theory was accurate, this problem needs to be addressed.

Research Design

Description of the Model

Any analysis that seeks to identify the impact of a single factors (such as broken windows law enforcement) on the crime rate must also take into account the myriad other factors that together determine the level of crime in a community. CICG used a technique known as regression analysis in order isolate the influence of a single factor on the crime rate while controlling for other factors known to influence crime. Regression analysis permits researchers to examine changes in a dependent variable (i.e., outcome variable) that can be explained by changes in an independent variable (i.e., the variable thought to predict the outcome), while controlling for other factors. CICG developed such a regression model to examine the influence of broken windows policing on the crime rate, controlling for other factors known to influence the crime rate.

Numerous studies have examined the link between social and economic factors and the crime rate. Building on this previous research, a regression model that controlled for many of the factors known to influence the crime rate was developed:

Dependent Variable

The dependent variable in the analysis was the property crime rate. This variable was measured by adding the number of reported burglaries, larcenies, and motor vehicle thefts in a given county/year and dividing that number by the county's population. The property crime rate was selected for analysis in place of the violent crime rate because the property crime rate is significantly higher than the violent crime rate and subject to much more variation by county (in certain rural counties the violent crime rate is almost non-existent and, as a result, a very small number of crimes can dramatically alter the rate from year to year).[5]

It is important to note that the property crimes included in the analysis are those found in the FBI's crime index. These are felonies, not misdemeanors. The outcome measure, therefore, consists of serious crime. Had the outcome measure been property crimes of the misdemeanor variety, then the analysis would not be testing the broken windows thesis because the theory states that control of minor problems precedes its effect on serious crimes.

Independent Variables

Two key independent variables included in the analysis are designed to measure the extent of broken windows policing. The first was the number of misdemeanor arrests divided by total arrests for all felonies and misdemeanors. This variable is termed the Misdemeanor Arrest Ratio. Consistent with the broken windows thesis, a more aggressive focus on minor crimes (misdemeanors) would be expected to reduce the rate for serious crime.[6]

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[5] Incidentally, virtually identical results were obtained by running the same regressions reported below with the violent crime rate as the dependent variable.

[6] This analysis did not explore whether higher arrest rates for certain *types* of misdemeanors were better predictors than the overall misdemeanor arrest rate.

The second key explanatory variable was the Misdemeanor Filings Ratio, defined as the number of misdemeanor filings (i.e., charges filed) divided by the total reported number of index crimes. The broken windows thesis emphasizes the role of *police* activity in reducing serious crime, but researchers should also consider whether charges are filed for misdemeanor offenses. Misdemeanants can be arrested, jailed, and released without charges. The filing of formal charges, however, can serve to further increase the consequences associated with minor crime and thereby discourage more serious crime. In addition, the filing of charges can send a signal to would-be offenders that the county does not tolerate minor offenses and treats them very seriously. Thus, the filings variable serves as another "check" on the validity of the broken windows thesis. It assumes that prosecutors in addition to police officers and sheriff's deputies can influence the incidence of serious crime by aggressively targeting minor problems.

Several control variables were also included in the analysis. These variables can be organized into three categories: (1) deterrence (2) economic and (3) demographic variables. First, assuming that people make rational decisions whether to commit crime, it can be expected that criminal justice activities thought to have a deterrent effect on would-be offenders will be associated with less crime. Next, it is well established that certain economic conditions, such as poverty and unemployment, are associated with the crime rate. Finally, criminologists have found repeatedly that certain demographic characteristics, such as the percentage of young people in the population, are associated with crime rates.

The first deterrence variable was the probability of arrest for property crime, measured by dividing the number of arrests for property crime by the number of property crimes reported. The second deterrence variable was the percentage of people held in custody. This was measured by dividing the number of people held in custody in a given county/year by population. Presumably, the higher the percentage of people held in custody, the greater deterrent effect this will have on would-be criminals (e.g., Marvell and Moody 2001).

Two economic control variables were also included in the analysis. The first, per capita welfare, was measured by dividing the number of people on public assistance in a given county/year by the county's population. Next, per capita unemployment was measured by dividing the number of unemployed persons by population. These variables—and related ones—have been included in countless macro-level studies of crime (e.g., Shepherd 2001; Marvell and Moody 2001; Worrall et al, 2001).

Finally, six demographic control variables were included. The first was the percentage of young people between the ages of 13 and 17. The second was the percentage of young people between the ages of 18 and 25. The third was the percentage of African Americans in each county.[7] Next, a variable for population density was estimated by dividing the number of people in a given county by that county's area in square miles. Finally, the percentage of high school dropouts was determined for each observation. Each of these variables has been utilized extensively in past criminological research.[8]

[7] This analysis did not include the percentage of Hispanics because this racial category is no longer a minority in the state of California. The theory used to justify the inclusion of this variable, social threat theory, does not apply.
[8] No measure of family disruption was included because the data were not available at the county level in yearly increments.

Data Sources

This study uses official data from the state of California for the years 1989-2000. The data used come from a number of state sources. The data for the dependent variable came from the State Criminal Justice Statistics Center. Data were also supplied by the State Controller's Office and the California Department of Finance.

By selecting counties as the unit of analysis, this study extends what is already a long criminological history of county-level studies of crime (see, e.g., Baller, Anselin, Messner, Deane, and Hawkins, 2001; Gillis, 1996; Guthrie, 1995; Hannon and DeFronzo, 1998; Kowalski and Duffield, 1990; Kposowa and Breault, 1993; Kposowa *et al.*, 1995; Petee and Kowalski, 1993; Phillips and Votey, 1975; Worrall et al, 2001).

Counties are an appropriate level of analysis in the present context for two reasons. First, data for the control variables included in the analysis are only available at the county-level. Census data permit lower levels of analysis, but because the study contains data collected in yearly increments (as opposed to every ten years, as in the Census), this data could not be incorporated in the analysis.

Next, this analysis attempts a general test of the broken windows thesis, not a place-specific one. The results of this analysis do not assume that any specific county (or any combination of cities within said county) is consciously pursuing broken windows policing. Instead, this analysis seeks to determine whether more attention to minor problems *overall* results in the added benefit of a reduction in serious crime.

Estimation Technique

The regression models used in this analysis are known as "two-way fixed-effects regression models." For a complete discussion of these models, please refer to Appendix A. A brief description, however, is worthwhile at this point.

The two-way fixed effects approach addresses the statistical problems which can result when analyzing data collected on the same units (California's 58 counties) over several years. More specifically, two-way fixed-effects estimation allows researchers to control for unobserved, time-stable characteristics of given counties (such as unmeasured demographic characteristics) as well as events in a given year that affect all counties (such as economic fluctuations or changes in state-level public policy).[9] Thus, the fixed-effects approach actually serves to control, albeit indirectly, for several other variables linked to the crime rate, but for which data are not available.

Results

The results from the regressions are reported in Tables 1 and 2. Table 1 reports the results from the analysis with the property crime rate as the dependent variable and with the misdemeanor *arrest* ratio as the primary independent variable of interest. Table 2 reports the results from the analysis with the

[9] Not only does the two-way fixed-effects model take account of these factors, but when data are collected on the same units over time, additional statistical problems arise which are addressed by this approach. One, known as serial autocorrelation, is that the crime rates in each county are highly correlated from year to year. This problem is addressed as described in Appendix A. Further, because the crime rate varies widely across counties, and especially from rural to urban counties, steps need to be taken to reduce the influence of "outliers" (counties with excessively high or low values on the dependent variable). A weighting procedure compensates for this problem. It is also described in Appendix A.

property crime rate as the dependent variable and the misdemeanor *filing* ratio as the primary independent variable of interest.[10]

As can be seen from Table 1, the coefficient for the Misdemeanor Arrest Ratio variable is negative and highly significant. This suggests that as the number of misdemeanor arrests relative to total arrests *increases*, the property crime rate *decreases*. This is consistent with the broken windows thesis. Note also that, with the exception of Percent Black (which is not significant), all of the coeffi-

Table 1: Effect of Misdemeanor Arrest Ratio on Property Crime

Variable	Coefficient	Std.Error	T-statistic
Misdemeanor Arrest Ratio	-0.0367	0.0078	-4.73***
Probability of Arrest for Prop. Crime	-0.0099	0.0032	-3.12**
Per Capita Welfare	0.0311	0.0206	1.51
Per Capita Unemployment	0.0005	0.0002	1.95*
Percent Male 13 to 17	1.223	0.2779	4.40***
Percent Male 18 to 25	0.2978	0.0774	3.85***
Percent Black	-0.0248	0.146	-0.17
Per Capita Held	-1.583	0.3987	-3.97***
Density	1.30E-06	5.65E-06	0.23
Dropout Rate	0.0004	0.0002	1.88*

Notes: * = $p < .10$; ** = $p < .05$; *** = $p < .01$; coefficients for year and county dummies not reported.

Table 2: Effect of Misdemeanor Filings Ratio on Property Crime

Variable	Coefficient	Std. Error	T-statistic
Misdemeanor Filings Ratio	-0.0021	0.0003	-8.04***
Probability of Arrest for Prop. Crime	-0.0036	0.004	-0.88
Per Capita Welfare	0.0122	0.0366	0.33
Per Capita Unemployment	0.0003	0.0003	0.98
Percent Male 13 to 17	1.358	0.3118	4.36***
Percent Male 18 to 25	0.2151	0.0876	2.46**
Percent Black	0.0974	0.173	0.56
Per Capita Held	-1.305	0.4221	-3.09**
Density	-9.81E-06	5.92E-06	1.66*
Dropout Rate	0	0.0002	0.868

Notes: * = $p < .10$; ** = $p < .05$; *** = $p < .01$; coefficients for year and county dummies not reported.

[10] One potential criticism of the approach employed here is that, by using the misdemeanor arrest ratio as the key explanatory variable, the results are simply showing a correlation between increases in misdemeanor arrests and decreases in serious crime rather than indicating causality. That is, it could be argued that the results simply show that as serious crime declines (for whatever reason), so too will arrests for serious crimes, which will result in an increase in the misdemeanor arrest ratio as the number of arrests for misdemeanors is held constant and the total number of arrests declines. To test this hypothesis, a regression analysis similar to the one presented here was performed, but controlling for the total number of arrests. The results were very similar to the results presented here, with no significant changes in the direction or magnitude of the key relationships under study.

cients for the remaining variables are in the expected directions, and most are statistically significant.

The results reported in Table 2 are consistent with those reported in Table 1. As expected, the coefficient for the Misdemeanor Filings Ratio variable was negative and highly significant. This leads to the conclusion that, as the number of court filings for misdemeanors relative to all offenses increases, the property crime rate decreases. Thus, it appears that prosecutors—in addition to the police—can reduce serious crime (again, as measured by the property crime rate) by aggressively prosecuting misdemeanors.

Conclusions and Policy Options

During the past several years, crime rates have fallen to levels not seen for decades or more. Nevertheless, recent data indicates that the trend toward lower crime rates is slowing and perhaps even beginning to reverse direction. As crime rates have fallen, the debate about the possible causes for the decline has heated up. Law enforcement agencies, researchers, members of the media, and elected officials have all advanced theories about the causes of the change in crime rates.

Among the important policies cited as a cause of the fall in crime rates in communities throughout the state (and nation) is the broken windows approach to law enforcement. Proponents of broken windows law enforcement argue that by targeting minor offenses, more serious crimes can be avoided in the future.

In spite of the increasing intensity of the debate over law enforcement strategies, researchers have thus far failed to adequately answer an important question about broken windows law enforcement: Does it work? This report is an attempt to answer this critical question.

The results presented in this report indicate that broken windows law enforcement strategies can be effective in reducing more serious crime. Specifically, the results of this analysis indicate that an increase in arrests for minor offenses is associated with a reduction in more serious crimes. In addition, the results indicate that an increase in charges filed by district attorneys for minor offenses is also associated with a reduction in more serious crimes.

Thus, policy makers considering the implementation or continuation of a broken windows law enforcement strategy can do so with the knowledge that these strategies are likely to be effective in reducing serious crime.

Directions for Future Research

The results presented in this analysis indicate that vigorous enforcement of minor offenses on the part of law enforcement agencies can lead to a reduction in serious crime. While these results provide an indication of the effectiveness of broken windows law enforcement strategies, they do not paint a complete picture. Specifically, data limitations prevented an analysis at the level of the individual jurisdiction. Instead, these results used the county as the unit of analysis. To more fully explore the effectiveness of broken windows law enforcement, an analysis of crime rates and law enforcement strategies in individual jurisdictions over time would be required.

To many observers broken windows implies a specific strategy or model at the level

of the individual law enforcement agency. This is not disputed here. Indeed, within a single county many agencies may be consciously pursuing a broken windows model of policing, while others may not. Thus, the results reported here may suffer from aggregation bias (i.e., lumping all law enforcement agencies in a single county together). However, because of the lack of previous research examining the relationship between policing minor problems and serious crime, using longitudinal data, and controlling for other factors linked to crime, the findings reported here can help to test the accuracy of Wilson and Kelling's theory.

Despite its apparent advantages, broken windows law enforcement has been criticized for the costs imposed on communities as a result of the more aggressive policing tactics supported by the theory. The strategy's potential negative consequences are an important element of any decision to proceed with implementation of a broken windows law enforcement strategy. An exploration of these effects is therefore an important next step.

Appendix A: Detailed Discussion of the Regression Models

The data used in this analysis are of the time-series—cross-section (TSCS) variety. TSCS data differ little from cross-sectional data; where in cross-sectional data sets the observations are single units, TSCS data sets contain observations repeated over each unit. Throughout this appendix the subscripts, *i* and *t*, are used to refer to units and time periods, respectively. As indicated earlier, the units of analysis were counties and the data were collected in yearly increments.

The results from equations (1) and (2) are reported here. These equations closely approximate many macro-level models of crime (e.g., Kovandzic et al., 1998; Osgood, 2000; Smith and Parker, 1980; Warner and Roundtree, 1997; Williams and Flewelling, 1988; Lynch et al., 1994; Mathur, 1978; Pogue, 1975; Swimmer, 1974). The notable difference between the two equations is the inclusion of $\beta_1 MIS_{it}$, the ratio of misdemeanor arrests relative to all arrests in county *i* at time *t*, and $\beta_1 FIL_{it}$, the ratio of misdemeanor filings relative to all index property crime. Equations (1) and (2) are as follows:

$$PCR_{it} = a_i + \beta_1 MIS_{it} + \beta_2 PA_{it} + \beta_3 PH_{it} + \beta_4 E_{it} + \beta_5 D_{it} + \beta_6 TD_t + u_{it} \quad (1)$$

$$PCR_{it} = a_i + \beta_1 FIL_{it} + \beta_2 PA_{it} + \beta_3 PH_{it} + \beta_4 E_{it} + \beta_5 D_{it} + \beta_6 TD_t + u_{it} \quad (2)$$

The notation for equations (1) and (2) is:

PCR = Property Crime Rate

MIS = Misdemeanor Arrests as a Percentage of Total Arrests

FIL = Misdemeanor Filings as a Percentage of all Index Crime Filings

PA = Probability of Arrest for Property Crime

PH = Per Capita Held

E = Economic Control Variables (per capita welfare, & unemployment)

D = Demographic Control Variables (% 13-17, % 18-25, % black, density, dropout)

TD = Time Dummies

u = Error Term

a_i = County Dummies

As an added check on the analysis, equation (3) was estimated in conjunction with equation (1) and equation (4) in conjunction with equation (2), using the method of two-stage least squares (2SLS). First, equations (3) and (4) were estimated (first stage), then the predicted *MIS* and *FIL* coefficients from each were entered into equations (1) and (2) (second stage). Two-stage least squares was selected because of the possible endogeneity of the broken windows policing variables, *MIS* and *FIL*, in equations (1) and (2).

The analysis utilized the two-stage least squares procedure to control for the possibility that a simultaneous relationship exists between serious crime (as measured by the property crime rate) and broken windows policing (i.e., because of the endogeneity problem discussed earlier). In other words, this procedure controls for the possibility that not only does broken windows policing affect crime but crime, in turn, affects whether broken windows policing is prioritized. Equations (3) and (4) are therefore as follows:

$$MIS_{it} = \eta_i + \delta_1 PCR_{it} + \delta_2 PO50_{it} + \delta_3 TD_t + \nu_{it} \quad (3)$$

$$FIL_{it} = \gamma_i + \psi_1 PCR_{it} + \psi_2 JE_{it} + \psi_3 TD_t + \xi_{it} \quad (4)$$

The notation unique to equations (3) and (4) is:

$PO50$ = Percent of Population Over 50

JE = Per Capita Judicial Expenditures

η_i & γ_i = County Dummies

ν_{it} & ξ_{it} = Error Terms

The results from the two-stage procedure are not reported in the main body of the paper, but can be found in this Appendix. Furthermore, no formal test for the endogeneity of the *MIS* and *FIL* variables was performed, but previous research suggests that they are endogenous (e.g., Shepherd 2001; Dezhbakhsh, Rubin, and Shepherd 2001). Next, equations (1) – (4) are all over-identified, which permits two-stage least squares. Finally, previous research suggests that the instruments in equations (3) and (4) are valid (Shepherd 2001).

The following section presents the results from the two-stage least squares analysis, the next section consists of a discussion of the functional form and estimation issues raised in this analysis. Table 3 here corresponds to Table 1 in the paper and Table 4 here corresponds to Table 2 in the paper. (The coefficients from the regressions in the first-stage are not reported here, but are available from CICG on request).

Table 3: 2SLS Analysis of the Effect of Misdemeanor Arrest Ratio on Property Crime

Variable	Coefficient	Std. Error	T-statistic
Misdemeanor Arrest Ratio	-0.5682	0.0048	-117.57***
Probability of Arrest for Prop. Crime	-0.0035	0.0028	-1.27
Per Capita Welfare	-0.0014	0.0015	-0.97
Per Capita Unemployment	0	0	1.1
Percent Male 13 to 17	0.495	0.0417	11.88***
Percent Male 18 to 25	0.0272	0.0158	1.72*
Percent Black	-0.0236	0.0241	-0.98
Per Capita Held	0.0034	0.0524	0.07
Density	0	8.73E-07	-12.34***
Dropout Rate	-1.39E-07	0	-0.01

Notes: * = $p < .10$; ** = $p < .05$; *** = $p < .01$; coefficients for year and county dummies not reported.

Table 4: 2SLS Analysis of the Effect of the Misdemeanor Filings Ratio on Property Crime

Variable	Coefficient	Std. Error	T-statistic
Misdemeanor Filings Ratio	-0.0116	4.87E-06	-2372.92***
Probability of Arrest for Prop. Crime	-0.0003	0.0002	-2.28**
Per Capita Welfare	0.0001	0.0001	1.53
Per Capita Unemployment	-2.71E-07	1.98E-06	-0.14
Percent Male 13 to 17	-0.0011	0.0015	-0.7
Percent Male 18 to 25	0	0.0003	-0.04
Percent Black	0.0004	0.0008	0.56
Per Capita Held	-0.0029	0.0031	-0.93
Density	-5.88E-08	4.57E-08	-1.29
Dropout Rate	5.90E-07	1.40E-06	0.42

Notes: * = $p < .10$; ** = $p < .05$; *** = $p < .01$; coefficients for year and county dummies not reported.

As can be gleaned from Tables 3 and 4, the t-statistics for the Misdemeanor Arrest Ratio and Misdemeanor Filings Ratio are in the expected directions and highly significant. Thus, having controlled for the endogeneity of the arrest and filings variables (as well as the probability of arrest, which is arguably endogenous), it still appears that police officers and prosecutors actions, particularly as manifested through an aggressive stance on misdemeanors, can influence the serious crime rate. Some of the remaining coefficients were significant and *not* in the expected directions, but the t-statistics associated with most of these variables are small relative to those for the arrest and filings variables.

Functional Form and Estimation Issues

Many researchers select single or double log formulations for testing models where the data display non-normality. The log form is sometimes desirable for individual-level analysis. However, where, as here, the equations are simply aggregated models of individual (police agency) behavior, the log form is inappropriate (one cannot add several individual-level logged equations and expect to obtain a logged equation). As such, a linear formulation for estimating equations (1) – (4) was used. This functional form is consistent with previous research involving macro-level models of crime (see, e.g., Shepherd 2001; Dezhbakhsh et al. 2001).

Functional form considerations notwithstanding, additional estimation issues arise in the TSCS context. First, a unique form of heteroskedasticity frequently presents itself in the analysis of TSCS data. "Panel heteroskedasticity"[11] can affect whole units at a time since error variances for a given unit may display time dependence. Non-constant variance is a likely violation of Gauss-Markov assumptions in TSCS data. For example, a rural county's crime rate is likely to differ significantly from an urban county's crime rate, which, in turn, is likely to contribute to nonconstant error variances. Panel heteroskedasticity was present[12], so the regressions were weighted by the square root of population.

Next, it is rarely the case that observations within TSCS data are independent along the time dimension. As a result, serial dependence (often referred to as serial autocorrelation and/or temporal autocorrelation) is often a problem that needs to be overcome. It is not uncommon for the values of a particular unit from one time period to be associated with values for the same unit from another period (Hanushek and Jackson, 1977; Maddala, 1992). And, indeed, tests revealed that this problem was present.[13] To correct for serial dependence, equations (1) – (4) were estimated with first-order autoregressive distur-

[11] Panel heteroskedasticity, compared to ordinary heteroskedasticity, allows the error variances to vary from unit to unit while requiring that they be constant within each unit.

[12] A simple technique for detecting panel heteroskedasticity was proposed by Franzese (forthcoming). He suggests regressing the absolute values of the OLS residuals on the X variable that is thought to be closely associated with the errors. In the case of TSCS data, the unit-specific dummy variables (minus one) are those mostly likely to be associated with the error term. After all, the very term "panel heteroskedasticity" suggests nonconstant variance across units.

[13] A straightforward method for detecting serially correlated errors in the TSCS context is via the TSCS analog of the standard Lagrange multiplier test. This is accomplished by estimating the respective OLS regression equation and then regressing the residuals on all of the independent variables and the lagged residual. If the coefficient on the lagged residual is significant, then the null hypothesis of independent errors can be rejected. These steps are taken to detect a first-order autoregressive process. The test can be refined to detect higher-order serial autocorrelation by the addition of multiple lags for the captured OLS residuals. This approach is acceptable when the variables on the right-hand side of the equation are endogenous or exogenous, but not with a lagged dependent variable on the right-hand-side of the equation (see Beck and Katz 1996).

bance terms, estimating ρ by β from the residual regression of $u_{it} = \beta u_{i,t-1}$.

Next, the addition of county dummy variables acknowledges that there may be inherent features of individual units that affect the outcome of interest that are not adequately captured by any of the regressors included in the model (i.e., heterogeneity). For example, Cherry (1999; see also Cornwell and Trumbull 1994) has pointed out that cross-jurisdictional variations introduce "noise" into macro-level crime analysis, which may bias results. Marvell and Moody (1995) and Moody and Marvell (1987) also succinctly describe the logic for modeling heterogeneity in this fashion.

Finally, the addition of *time*-specific dummy variables acknowledges that all the units in the model could be subject to common events in any given year (e.g., a change in the health of the economy). It is well known, for example, that California entered an economic recession during the early 1990s. All counties throughout the state felt the brunt of this recession with smaller budgets compared to the years before the recession. This time effect (to the extent it exists) is frequently taken into account through a series of dummy variables for year, otherwise random year-to-year variations could contaminate the *X-Y* relationship specified in the model.

A Note Concerning Lagged Effects

The effects of lags of the arrest and filings variables on property crime were not explored in this paper. Instead, it is assumed that police and prosecutors can have an effect on the incidence of serious crime within the same year. Wilson and Kelling's broken windows theory suggests something of a delayed effect between minor offenses and more serious problems, which, in turn, suggests that lags of the primary independent variables (Misdemeanor Arrest Rate and Misdemeanor Filings Rate) would be appropriate; however, there are two reasons why lagged effects were not explored.

First, for every lag, 58 observations (for all 58 counties) would be lost. Since the data do not contain observations on a great number of years, this loss of sample size was not acceptable. Second, while Wilson and Kelling argued that minor problems precede serious problems, they did *not* argue that the *response* to minor problems (arrests and filings) has a delayed effect on serious crime. It is assumed that police officers and prosecutors can, by aggressively targeting misdemeanors, reduce the serious crime rate within a one-year period. However, it may behoove future researchers to explore lagged effects.

Appendix B: Previous Research on Broken Windows

While few *direct* tests of the broken windows theory have been performed, many researchers have tested some of the ideas that flow from (and led up to) Wilson and Kelling's seminal argument. The literature can be organized into two broad categories: (1) the effects of fear and disorder on crime and (2) the effects of certain policing strategies on crime and disorder. The research on the latter has, in turn, been organized into two categories: (a) aggressive policing and (b) quality-of-life policing (Katz, Webb, and Schaefer 2001). Both strategies find support in the broken windows theory. Aggressive policing targets minor crime problems with vigor; quality-of-life policing seeks to maintain social order.[14]

Fear, Disorder, and Crime

Skogan (1990) was one of the first researchers to examine the relationship between fear, disorder, and crime, phenomena considered inextricably linked by supporters of Wilson and Kelling's broken windows theory. He reported on a survey of 13,000 residents in 40 neighborhoods of six different cities and found that crime and fear were linked to disorder. He concluded that this relationship was even stronger than that between poor socioeconomic conditions and crime. He also concluded that disorder *preceded* crime in the neighborhoods surveyed. His research seemed to provide empirical support for the broken windows theory.

Research subsequent to Skogan's has cast some doubt on his conclusions. For example, Harcourt (1998) reanalyzed Skogan's data and found that disorder, fear, and crime were not tightly linked. This led Eck and Maguire (2000) to conclude that "Skogan's results are extremely sensitive to outliers and therefore do not provide a sound basis for policy" (p. 24). Another researcher, Taylor (1999), also criticized Skogan's research, claiming that his research design was flawed.

Aggressive Policing

One method of policing that finds support in Wilson and Kelling's view is so-called "aggressive policing." The police, it is argued, must expend great effort targeting minor crime and disorder problems in order to send a signal that such problems will not be tolerated in the community. Indeed, this idea is nothing new, and it finds roots in policing practices that preceded the broken windows thesis.

Wilson and Boland (1978) were among the first researchers to examine the relationship between aggressive policing and crime. They found an inverse relationship between the number of traffic tickets and serious crime. That is, as the number of tickets increased, the serious crime declined. In another study that preceded the broken windows theory, Cordner (1981) examined the relationship between aggressive directed patrol on robbery, burglary, auto theft, and theft from vehicles. He found that when police officers engaged extensively in vehicle stops and questioning of suspicious persons, offense rates declined.

Later research by Sherman (1990) and Sherman, Gartin, and Buerger (1989) supports a similar conclusion. They found that aggres-

[14] Another policing approach finding support in the broken windows thesis is "community policing." However, in many ways community policing overlaps with the three law enforcement strategies discussed here. Therefore, no special section on community policing was included.

sive enforcement of the laws in crime "hot spots" causes crime to decline. This finding has spawned an extensive body of "hot spots" research (e.g., Sherman and Rogan 1995; Weisburd and Green 1995).

Quality-of-Life Policing

Past research also seems to support a policing strategy geared toward reducing social and physical disorder. This strategy assumes that as signs of disorder are reduced, community members will be more inclined to associate with one another, care for their neighborhoods, and work jointly to promote safety and otherwise send a signal that crime is not welcome. Quality-of-life policing has found a wealth of support in the law enforcement community (e.g., Bratton 1996; Kelling and Bratton 1998) as well as in academia (e.g., Roberts 1999; Kelling and Coles 1996).

Sherman (1990) was one of the first researchers to study the effects of quality-of-life policing on serious crime. He found that focused enforcement of public drinking laws and parking regulations, when first publicized, caused citizens to feel safer. The strategy did not, however, appear to exert an influence on serious crime. In a more recent study, Novak et al. (1999) came to a similar conclusion. They found that enforcement of liquor laws did not affect the incidence of robberies or burglaries.

What appears to be the most recent study of quality-of-life policing paints a somewhat grim picture of the effectiveness of this strategy. Katz et al. (2001) examined the Chandler, Arizona Police Department's quality-of-life initiative in terms of its effects on police calls for service in several categories. These included calls for person crime, property crime, drug crime, suspicious persons, assistance, public morals, physical disorder, nuisance, disorderly conduct, and traffic (p. 844). They found that quality-of-life policing reduces physical disorder and public morals offenses (e.g., prostitution), but little else. This is not a surprising conclusion considering that a major component of the Chandler initiative involved policing physical disorder (mainly through code enforcement) and public morals offenses.

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